C6820 Enhanced JPEG Module

User Manual

V2.0

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PART I - Hardware

Overview

The Purpose of this document is the description of the features, functions and interfaces of **C6820 Enhanced JPEG Camera Module**.

The **Enhanced JPEG Module** is a small, lightweight and low power consumption device including most of the features of a Digital Still Camera (DSC) such as snapshot, video capture, date-time stamp, file management and many system configurations.

A series of user-friendly command is well developed. By sending these commands to the camera, users can perform the functions of the camera.

In this document, all the functions of the JPEG Module will be taken into account and for each of the functions, a proper command sequence will be suggested.

Features

- UART interface for camera control
- User friendly commands
- Different baud rate setting to meet most of MCU and PC software
- SD card interface
- Real time composite video data output
- USB mass storage

Module Specifications

Image Sensor	3M CMOS sensor OV3620
Image Processor	ZORAN COACH-6E
On Board Memory	128 Mb (8 Mbytes)
Storage	External memory card up to 4GB Resident 32MB NAND Flash
Display Connector	Composite video out
Video Capture	640 × 480 (30 fps) 320 × 240 (30 fps) Unlimited Motion JPEG capturing time depends on available memory space
Photo Resolution	1280 × 960, 640 x 480 JPEG format
White Balance	Normal / Daylight / Tungsten / Fluorescent / Cloudy
UART Baud Rate	115200 / 57600 bps
TV out	NTSC / PAL
USB Interface	USB 1.1 Mass storage mode Supported OS: Win2000 / XP / ME
Power	DC 5V

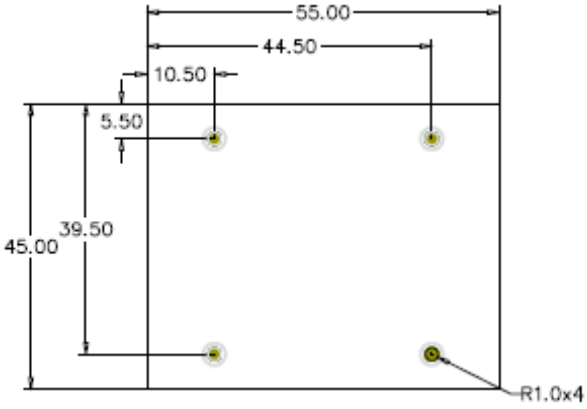
Electrical Characteristics

** Operation at DC 5.0V*

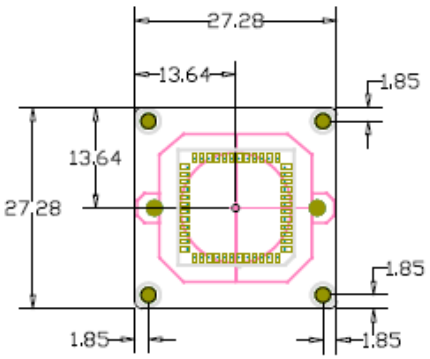
No TV connect			
Condition	**Min.**	**Max.**	**Units**
Idle (Peak @ downloading)	164	168	mA
Capture JPG (Peak @ capturing)	225	270	mA
Capture AVI (Peak @ recording)	286	295	mA
TV output			
Condition	**Min.**	**Max.**	**Units**
Idle (Peak @ downloading)	165	168	mA
Capture JPG (Peak @ capturing)	226	272	mA
Capture AVI (Peak @ recording)	286	300	mA
Playback JPG	180	220	mA
Playback AVI	195	225	mA

Mechanical Dimension

Main Board



Sensor Board



General Product Description

Voltage Supply
The external power supply must be connected to the camera and fulfill the following requirements.

- Nominal operating voltage: DC 5.0V
- Operation voltage range: DC 4.5V – 5.5V

Sensor
It is a CMOS type image sensor of Mega pixels. The flexible PCB connector is used to connect sensor board to main board.

Photo Capture
The JPEG Module supports **1280 x 960, 640x480** resolution and different compression ratios from **1x – 45x**.

Video Capture
The JPEG Module features unlimited video capturing, dependent on the memory size, with two optional resolutions: **640 x 480 (30fps), 320 x 240 (30fps)** in **AVI**. The JPEG Module provides different compression ratios from **1x – 45x**

Storage
The JPEG Module features a 32**MB** (32M x 8 bits) on-board NAND flash and supports up to **4GB** (optional) external memory card.

Display
The JPEG Module provides composite video output. Users can select TV standards, NTSC or PAL.

Serial Interface
The JPEG Module features an UART core, based on the industry standard PCI116550 UART device. It supports full duplex such that users can communicate with it on flexible platforms. The supported baud rates are: **115200bps, 57600bps**

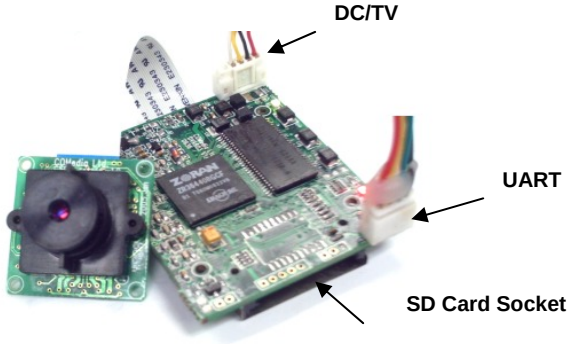
USB
The JPEG Module provides a USB Mass Storage interface, such that user can upload the image from the module to PC without driver installation. (For Windows 2K, XP or Later Version)

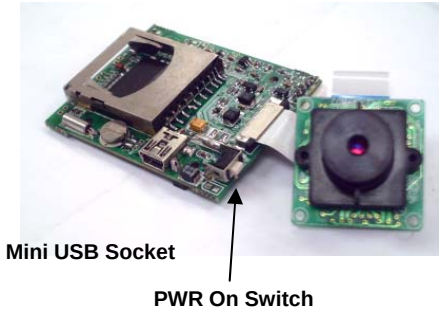
Interface Connectors

The JPEG Module has 3 interface connectors:

Connector	Description
USB	Mini USB to connect PC for data transfer
DC/TV	Adapter Cable provided for Video and DC input
UART	UART cable connector to the backend device

The positions of the connectors are shown below:





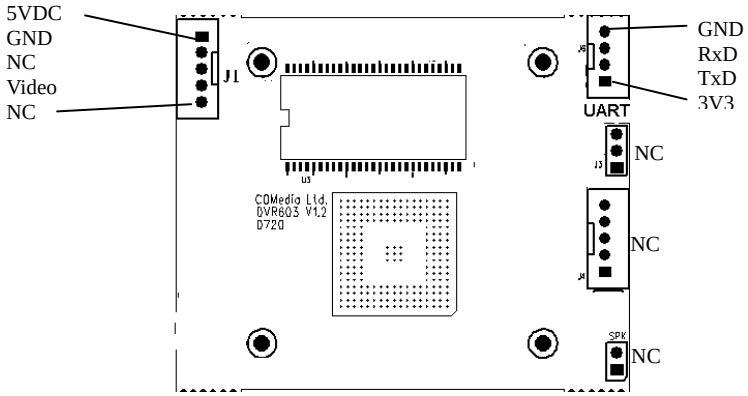
The pin assignments of the interface connectors are shown in the following.

USB I/F Pin-out				
USB mini-B				
Pin	**Signal**	**I/O**	**Function**	**Type**
1	Vbus		Power from PC USB port (5VDC)	Power
2	D-	I/O	USB D minus signal	Data
3	D+	I/O	USB D plus signal	Data
4	NC		Not connected	NC
5	GND		Ground	Power

UART I/F Pin-out				
4 x 1 – 2.0mm Pitch Socket DIP Type				
Pin	**Signal**	**I/O**	**Function**	**Type**
1	C3V3		Digital +3.3V	Power
2	TXD	O	UART serial transmitter output	Data
3	RXD	I	UART serial receiver input	Data
4	DGND		Digital ground	Power

DC/TV Pin-out – J1				
5 x 1 – 2.0mm Pitch Socket DIP Type				
Pin	**Signal**	**I/O**	**Function**	**Type**
1	V in		Power 5VDC	Power
2	GND		Power Ground	Power
3	NC		Not connect	NC
4	Video Out	O	Digital ground	Analog
5	NC		Not connect	NC

Connector pin assignment



PART II – Command List

Basic Operation

Hardware ON/OFF

To turn on the JPEG Module, press and hold the PWRON switch for one second and then released. LED will turn on. The same circuitry can be used for power off.

Synchronization to the module

Before "talking" to the module, the host should send sync command to the module and make connection.

0xaa 00 b0 04 aa (wait 10ms)

Repeat until the module response

0xaa 01 b0 00 05 aa

Refer to command 0xb0 (176) for details.

Software Shutdown

To shutdown the camera through software,

- Send the shutdown command:

0xaa 00 01 55 aa

- wait for the "OK" response:

0xaa 00 01 00 56 aa

After sending the OK response, the camera will be shutdown immediately.

Refer to command 0x01 (1) for details

Note: after shut down, need to press the PWRON KEY to restart again.

Connecting to TV monitor

Connect the DC/TV adapter cable, RCA socket to TV monitor, will display the video image on TV set and perform playback function when control thru the UART interface. This is NOT a must in real application. It is required when setup the camera or playback the files to TV set.

Connecting to PC

Connect USB cable to PC, the module acts as mass storage device. Note: no other functions can be performed when this USB connection existed.

Commands

Definition of Commands

To perform the functions of the JPEG Module, corresponding commands must be sent. The commands are string of the hexadecimal number. There are four types of commands being used for the JPEG Module: **ID Command**, **Parameter Command**, **ACK Command** and **Data Packet**.

All the commands contain **synchronization bytes** and **checksum**.
Synchronization byte (0xaa), placed at the front and the end of every command, is used for the synchronization between the host machine and the JPEG Module.
C**hecksum** is equal to the lowest eight bits of the sum of all the other bytes in the corresponding command. It is used for the verification of the command.

ID Command is a fixed five-byte command containing the command ID, the length of the parameters in the following parameter command and the checksum. Every function to be performed by the JPEG Module is labeled with a command ID. With the command ID, the camera knows which function will be performed and what kind of parameter will be received in the following. The format of ID command is shown in the following.

Format (Fixed Length of 5 bytes)	Sync Byte (8 bits)	Length of the parameter in unit of byte (8 bits)	Command ID in HEX (8 bits)	Checksum (8 bits)	Sync Byte (8 bits)
Example (Set the system clock)	0xaa	0x07	0x03	0x5e	0xaa

As shown in the example, the command ID is 0x03, setting the system clock and the size of the parameters in the following parameters is seven bytes.
Also, checksum = the lowest eight bits of (0xaa + 0x07 + 0x03 + 0xaa = 0x15e) = 0x5e.

Parameter Command is a varied length command contains the parameters corresponding to the previous ID command, such as date-time need to set. It is normally sent following the ID command. If the size of the parameter contained in the ID command is zero, no parameter command is required. The format of parameter command is shown in the following.

Format	Sync Byte (8 bits)	Parameter (variable)	Checksum (8 bits)	Sync Byte (8 bits)
Example (Set the system clock)	0xaa	0x07 0xd5 0x04 0x0c 0x11 0x36 0x00 (2005-04-12 11:54:00)	0x87	0xaa

ACK Command is a varied length command containing the acknowledgement and the results returned for the ID and parameter commands, such as the requested date-time and the version code. It contained also the length of the results and checksum for verification. The format of ACK Command is shown in the following.

Format	Sync Byte (8 bits)	Length of the return in unit of byte (8 bits)	Command ID to ACK (8 bits)	Return (variable)	Checksum (8 bits)	Sync Byte (8 bits)
Example (Request the system clock)	0xaa	0x07	0x04	0x07 0xd5 0x04 0x0c 0x11 0x36 0x00 (2005-04-12 11:54:00)	0x92	0xaa

Data Packet
It is used to transmit the picture or video files from the camera to the host machine when performing the download function. The format of data packet is shown in the following.

Format	Sync Byte (8 bits)	Serial number of the packet (16 bits) (from 0x0001 – 0xffff)	File content	Checksum (16 bits)	Sync Byte (8 bits)
Example	0xaa	0x0001	0x03 0x12 0x77… 0x5e	0xf655	0xaa

The checksum (16 bits) in the data packets is equal to the **lowest 16 bits** of the sum of the synchronization bytes, the serial number and the file content. This is different to other command with 8 bit checksum.

After receiving a data packet, the host machine should return an ACK command for acknowledgement. A list of return code for packet transmission is shown in the following.
Return: 0x00 Verification pass, ask for the next packet
0x01 Verification failed, ask to resent the current packet
0xff Transmission termination

Operation of the Commands

Operation Modes
There are 3 operation modes, ie. Idle, capture and playback mode. The command should be operated at its relevant operation mode, Some can be operated at either mode but some only effective at particular mode. Below are some examples:
1. system setup: can be either mode
2. set picture parameter should be in capture mode
3. down load data should be in idle mode

Details refer to the command 0x1e (30)

Operation Sequence
Some commands need to be sent in sequence before it can be executed. Refer to the details in command description. In addition, if there is a mistake during command sending, the host needs to resend the command, otherwise, it always Acks the fail message.

Summary of Commands

System Configurations		
ID in Dec	**ID in Hex**	**Function**
0	0x00	Restore factory configuration
1	0x01	Shutdown
2	0x02	Request the revision identification
3	0x03	Set the system clock
4	0x04	Resquest the system time
6	0x06	Snapshot configuration
30	0x1e	Select the operation mode
31	0x1f	Request the current operation mode
159	0x9f	Select the Baud rate
176	0xb0	Synchronization signal

JPEG Capture		
ID in Dec	**ID in Hex**	**Function**
50	0x32	Set the picture resolution and the compression ratio
51	0x33	Request the current Luminance
53	0x35	Date Time Stamping
54	0x36	String Stamping
56	0x38	Sequence capture

AVI Capture		
ID in Dec	**ID in Hex**	**Function**
81	0x51	Set the resolution and the compression ratio of the AVI recorded
84	0x54	Start / Stop recording AVI

File Management		
ID in Dec	**ID in Hex**	**Function**
120	0x78	Request the file information
121	0x79	Download file from the JPEG Module (Function in IDLE mode ONLY)
122	0x7a	Delete the targeted file
200	0xc8	Playback the current AVI
201	0xc9	Select the Previous / Next file
202	0xca	Select a particular file

Storage Media Management		
ID in Dec	**ID in Hex**	**Function**
100	0x64	Select the storage media
101	0x65	Format the storage media
102	0x66	Request the information of the current storage media

Interface Management		
ID in Dec	**ID in Hex**	**Function**
155	0x9b	Select the TV Standard
169	0xa9	Request the connection status of the external memory

List of Commands

0 - 0x00 - Restore factory configuration

ID	0x00
Description	Restore the configuration of the JPEG Module to the factory setting Parameter: n/a
ID Command	0xaa 00 00 54 aa
Operation Mode	Preview/playback mode
Parameter Command	n/a
Return from the JPEG Module	0x00: OK / 0x01: Failed / 0x02: USB Mode

Example:
Restore the configuration of the JPEG Module to the factory one

Host:
0xaa 00 00 54 aa
Wait for OK

Module:
0xaa 01 00 00 55 aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x00;
Return = 0x00 (OK);
Checksum = 0x55

Remark: factory configuration includes the following parameters:
wSize，eTVStd，eWBMode, eStrobeMode, eColorEffect, eImgQty, eImgRes, eAviQty, uAviRes, eContrast, eEV, uFrequency, eSharpness, uAviTriTime, uTrigMask, bTrigMode, bAudioOn

1 – 0x01 – Shutdown

ID	0x01
Description	Software shutdown the JPEG Module Parameter: n/a Note: after shut down, need to press the PWRON KEY to restart again.
ID Command	0xaa 00 01 55 aa
Operation Mode	Preview/playback mode
Parameter Command	n/a
Return from the JPEG Module	0x00: OK / 0x01: Failed

Example,
Software shutdown the JPEG Module

Host:
0xaa 00 01 55 aa
Wait for OK

Module:
0xaa 01 01 00 56 aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x01;
Return = 0x00 (OK);
Checksum = 0x56

2 – 0x02 – Request the revision identification

ID	0x02
Description	Request the revision numbers of the hardware, COACH, Sensor, and HCE Parameter: n/a
ID Command	0xaa 00 02 56 aa
Operation Mode	Preview/playback mode
Parameter Command	n/a
Return from the JPEG Module	0x$Y_{15}Y_{14}$ $Y_{13}Y_{12}$ $Y_{11}Y_{10}$ Y_9Y_8 Y_7Y_6 Y_5Y_4 Y_3Y_2 Y_1Y_0 $Y_{15}Y_{14}$ $Y_{13}Y_{12}$: Hardware Version $Y_{11}Y_{10}$ Y_9Y_8: Coach Version Y_7Y_6: Sensor Version Y_5Y_4: xx Y_3Y_2 Y_1Y_0: HCE Version / 0x01: Failed

Example,
Request the revision numbers of the hardware, COACH, Sensor, and HCE

Host:
0xaa 00 02 56 aa
Wait for Response

Module:
0xaa 08 02 62 b0 03 9e 08 03 01 08 1c aa
 # Length of the return = 8 bytes;
Command ID to ACK = 0x02;
Return = 0x0702 (Hardware ver.)
0x039e (COACH Ver.), 0x08 (Sensor Ver.),
xx, 0x0108 (HCE Ver.);
Checksum = 0x1c

3 – 0x03 – Set the system clock

ID	0x03
Description	Set the system clock Parameter: Year (2 bytes), Month (1 byte), Day (1 byte), Hour (1 byte), Minute (1 byte) and Second (1 byte)
ID Command	0xaa 07 03 5e aa
Operation Mode	Preview/playback mode
Parameter Command	0xaa Y_3Y_2 Y_1Y_0 M_1M_0 D_1D_0 H_1H_0 Mi_1Mi_0 S_1S_0 Ch_1Ch_0 aa Y_3Y_2 Y_1Y_0: Year (in hex) M_1M_0: Month (in hex) D_1D_0: Day (in hex) H_1H_0: Hour (in hex) Mi_1Mi_0: Minutes (in hex) S_1S_0: Second (in hex) Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed

Example
Set the system clock to 2004/11/19 18:10:00

Host:
0xaa 07 03 5e aa
0xaa 07 d4 0b 13 12 0a 00 69 aa
Wait for OK

Module:
0xaa 01 03 00 58 aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x03;
Return = 0x00 (OK)
Checksum = 0x58

4 – 0x04 – Request the system time

ID	0x04
Description	Request the system time Parameter: n/a
ID Command	0xaa 00 04 58 aa
Operation Mode	Preview/playback mode
Parameter Command	n/a
Return from the JPEG Module	0xY_3Y_2 Y_1Y_0 M_1M_0 D_1D_0 H_1H_0 Mi_1Mi_0 S_1S_0 0xY_3Y_2 Y_1Y_0: Year (in hex) 0xM_1M_0: Month (in hex) 0xD_1D_0: Day (in hex) 0xH_1H_0: Hour (in hex) Mi_1Mi_0: Minutes (in hex) S_1S_0: Second (in hex) / 0x01: Failed
Example, *Set the system clock* *Host:* **0xaa 00 04 58 aa** ***Wait for Response***	*Module:* **0xaa 07 04 07 d5 04 0F 17 1e 05 81 aa** *# Length of the return = 7 bytes;* *Command ID to ACK = 0x04;* *Return = 0x07d5 (Year: 2005), 0x04 (Month: 04), 0x0f (Day: 15), 0x17 (Hour: 23), 0x1e (Minute: 30); 0x05 (Second: 05) (2005/04/15 23:30:05);* *Checksum = 0x81*

6 – 0x06 – Snapshot configuration

ID	0x06
Description	Set the snapshot parameter Parameter: WhiteBalance Mode, EV, Contrast, ColorEff and Sharpness
ID Command	0xaa 05 06 5f aa
Operation Mode	Preview/playback mode
Parameter Command	0xaa Z_9Z_8 Z_7Z_6 Z_5Z_4 Z_3Z_2 Z_1Z_0 Ch_1Ch_0 aa Z_9Z_8: White Balance 0x00: Normal (Default), 0x01: Day Light 0x02: Tungsten, 0x03: Fluorescent, 0x04: Cloudy Z_7Z_6: EV 0x00 – 0x08 represent -2.0 – 2.0 in step of 0.5 (Default: 0x04) Z_5Z_4: Contrast 0x00: Normal (Default), 0x01: Stretch Z_3Z_2: Color Effect 0x00: Normal (Default), 0x01: B&W, 0x02: Sepia Z_1Z_0: Sharpness 0x00: Normal (Default), 0x01: Smooth, 0x02: Sharpen Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed

Example,
Set daylight for White Balance, 0 for EV, normal for Contrast, B&W for ColorEff, and Sharpen for sharpness

Host:	*Module:*
0xaa 05 06 5f aa	**0xaa 01 06 00 5b aa**
0xaa 01 04 00 01 02 5c aa	*# Length of the return = 1 byte;*
Wait for OK	*Command ID to ACK = 0x06;*
	Return = 0x00 (OK);
	Checksum = 0x5b

30 – 0x1e – Select the operation mode

ID	0x1e
Description	Select the operation mode Parameter: Idle Mode: For downloading and reviewing pictures and videos / Capture JPG (Default): Capture still picture(s) when receiving the snapshot command / Capture AVI: Capture a video when receiving the record command / Playback: Playback the taken pictures and video
ID Command	0xaa 01 1e 73 aa
Operation Mode	Preview/playback mode
Parameter Command	0xaa Z_1Z_0 Ch_1Ch_0 aa Z_1Z_0: Operation Mode 0x03: Idle, 0x04: Capture JPG, 0x05: Capture AVI, 0x06: Playback Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed / 0x02: USB mode

Example,
Select IDLE as the operation mode

Host:	*Module:*
0xaa 01 1e 73 aa	**0xaa 01 1e 00 73 aa**
0xaa 03 57 aa	*# Length of the return = 1 byte;*
Wait for OK	*Command ID to ACK = 0x07;*
	Return = 0x00 (OK);
	Checksum = 0x5c

31 – 0x1f – Request the current operation mode

ID	0x1f
Description	Request the current operation mode Parameter: n/a
ID Command	0xaa 00 1f 73 aa
Operation Mode	All modes
Parameter Command	n/a
Return from the JPEG Module	0x01: Failed / 0x02: USB Mode: Connected with the host through the USB port / 0x03: Idle Mode: Perform no function / 0x04: Capture JPG: Capture still picture(s) when receiving the snapshot command / 0x05: Capture AVI: Capture a video when receiving the record command / 0x06: Playback: Playback the taken pictures and video

Example,
Request the current operation mode

Host:
0xaa 00 1f 73 aa
Wait for Resopnse

Module:
0xaa 01 1f 05 79 aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x1f;
Return = 0x05 (Mode: Capture AVI);
Checksum = 0x79

50 – 0x32 – Set the picture resolution and the compression ratio

ID	0x32
Description	Set the picture resolution and the compression ratio Parameter: Resolution: 1280 x 960 / 640 x 480 Compression ratio: 1x – 45x (Default: 30x)
ID Command	0xaa 02 32 88 aa
Operation Mode	All modes
Parameter Command	0xaa Z_3Z_2 Z_1Z_0 Ch_1Ch_0 aa Z_3Z_2: Resolution 0x00: 1280 x 960, 0x01: 640 x 480 Z_1Z_0: Compression ratio 0x00 – 0x2c for 1x – 45x (Default: 0x18) Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed / 0x02: USB mode

For example,
Set 1280 x 960 for the picture resolution and 45x for the compression ratio

Host:
0xaa 02 32 88 aa
0xaa 00 2c 80 aa
Wait for OK

Module:
0xaa 01 32 00 87 aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x32;
Return = 0x00 (OK);
Checksum = 0x87

51 – 0x33 – Request the current Luminance

ID	0x33
Description	Request the current Luminance Parameter: n/a
ID Command	0xaa 00 33 87 aa
Operation Mode	Preview/playback mode
Parameter Command	n/a
Return from the JPEG Module	0xZ_3Z_2 Z_1Z_0 Z_3Z_2 Z_1Z_0: Luminance / 0x01: Failed / 0x03: Mode error

Example,
Request the current luminace

Host:
0xaa 00 33 87 aa
Wait for Response

Module:
0xaa 02 33 00 0d 96 aa
 # Length of the return = 2 bytes;
Command ID to ACK = 0x33;
Return = 0x000d (Luminance: 0x000d);
Checksum = 0x96

53 – 0x35 – Date Time Stamping

ID	0x35
Description	Stamp the date-time on the picture (note: NOT video clip) Parameter: Format (2 bits): The format of the date-time Corner (2 bits): Which corner to stamp the date-time Style (2 bits): The style of the date-time Enable (1 bit): Enable the function NC (1 bit): Must be "0"
ID Command	0xaa 01 35 8a aa
Operation Mode	Preview mode
Parameter Command	0xaa 0b$b_7b_6b_5b_4b_3b_2b_1b_0$ 0xCh_1Ch_0 aa b_7b_6: Format (2 bits) 00: yyyy mm dd, 01: yyyy/mm/dd, 10: dd/mm/yyyy, 11: mm/dd/yyyy b_5b_4: Corner (2 bits) 00: Bottom right, 01: Bottom left 10: Top right, 11: Top left b_3b_2: Style 00: Stamp only the date, 01: Stamp only the time 10: Stamp both the date and the time b_1b_0: Enable 00: Enable, 10: Disable Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed

Example,
Stamp the date in the format of dd/mm/yyyy and the time on the bottom right of the current picture

Host:
0xaa 01 35 8a aa
0xaa 88 dc aa
Wait for OK

Module:
0xaa 01 35 00 8a aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x35;
Return = 0x00 (OK);
Checksum = 0x8a

54 – 0x36 – String Stamping

ID	0x36
Description	Stamp a string on the picture, (NOT for video clip). This string will not see on the preview screen, only on the photo when play back. Parameter: Enable (1 byte): Enable the function FontW (1 byte): Width of the font(s) FontH (1 byte): Height of the font(s) PosX (2 bytes): X coordinate of the string (from left to right) PosY (2 bytes): Y coordinate of the string (from top to bottom) Red (1 byte): Red component of the RGB value Green (1 byte): Green component of the RGB value Blue (1 byte): Blue component of the RGB value StringLength (1 byte): Number of characters in the string (max 11) String (at most 11 bytes): ASCII code of the characters to display
ID Command	0xaa N_1N_0 36 Ch_1Ch_0 aa N_1N_0: Number of parameters Ch_1Ch_0: Checksum
Operation Mode	Preview/playback mode
Parameter Command	0xaa $Z_{21}Z_{20}$ $Z_{19}Z_{18}$ $Z_{17}Z_{16}$ $Z_{15}Z_{14}$ $Z_{13}Z_{12}$ $Z_{11}Z_{10}$ Z_9Z_8 Z_7Z_6 Z_5Z_4 Z_3Z_2 Z_1Z_0 (String) Ch_1Ch_0 aa $Z_{21}Z_{20}$: 0x00: Enable, 0x01: Disable $Z_{19}Z_{18}$: 0x00 – 0xff –width of the font $Z_{17}Z_{16}$: 0x00 – 0xff – height of the font $Z_{15}Z_{14}Z_{13}Z_{12}$: 0x00 – X coordinate of string $Z_{11}Z_{10}Z_9Z_8$: 0x00 – Y coordinate of string Z_7Z_6: 0x00 – 0xff -Red Z_5Z_4: 0x00 – 0xff -Green Z_3Z_2: 0x00 – 0xff -Blue Z_1Z_0: 0x01 – 0x0b –string length (max 11) (String): ASCII code of the characters to display, only capital letter is active Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed

Example
Stamp the string "HELLO" of that the font size is (W:80, H:90) and the RGB ratio is(0:0:255) at the (160, 150) of the picture

Host:
0xaa 10 36 9a aa
0x aa 00 50 5a 00 a0 00 96 00 00 ff 05 48 45 4c 4c 4f ac aa
Wait for Ok

Module:
0xaa 01 36 00 8b aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x36;
Return = 0x00 (OK);
Checksum = 0x8b

56 – 0x38 – Sequence capture

ID	0x38
Description	Capture a number of pictures (NOT for video clip) Parameter: Number of picture(s) (1 byte)
ID Command	0xaa 01 38 8d aa
Operation Mode	capture mode
Parameter Command	0xaa Z_1Z_0 Ch_1Ch_0 aa Z_1Z_0: Number of picture(s) 0x01 – 0xff Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed / 0x02: USB mode / 0x03: Mode error / 0x04: Memory full(RAM) / 0x05: Memory full (Flash) / 0x06: External memory card write-protect

Example,
Set to take a chain of 5 pictures with a single snapshot

Host:
aa 01 1e 73 aa
aa 04 58 aa
0xaa 01 38 8d aa
0xaa 05 59 aa
Wait for OK

Module:
0xaa 01 38 00 8c aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x38;
Return = 0x00 (OK);
Checksum = 0x8d

81 – 0x51 – Set the resolution and the compression ratio for AVI

ID	0x51
Description	Set the resolution and the compression ratio for AVI Resolution: 320 x 240 (Default) / 640 x 480 Compression ratio: 1x – 45x (Default: 30x)
ID Command	0xaa 02 51 a7 aa
Operation Mode	Preview/playback mode
Parameter Command	0xaa Z_3Z_2 Z_1Z_0 Ch_1Ch_0 aa Z_3Z_2: Resolution 0x00: 320 x 240 (Default), 0x01: 640 x 480 Z_1Z_0: Compression ratio 0x00 – 0x2c for 1x – 45x (Default: 0x1d) Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed

Example
Set 320 x 240 for the resolution and 20x for the compression ratio of the video

Host:
0xaa 02 51 a7 aa
0xaa 00 13 67 aa
Wait for OK

Module:
0xaa 01 51 00 a6 aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x51;
Return = 0x00 (OK);
Checksum = 0xa6

84 – 0x54 - Start / Stop recording AVI

ID	0x54
Description	Start / Stop recording AVI Parameter: Start / Stop
ID Command	aa 01 54 a9 aa
Operation Mode	AVI capture mode
Parameter Command	0xaa Z_1Z_0 Ch_1Ch_0 aa Z_1Z_0: Start / Stop 0x00: Start, 0x01: Stop Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed / 0x02: USB mode / 0x03: Mode error / 0x04: Memory full(RAM) / 0x05: Memory full (Flash) / 0x06: External memory card write-protect

Example,
Start recording AVI

Host:
aa 01 1e 73 aa
aa 05 59 aa
aa 01 54 a9 aa
0xaa 00 54 aa
Wait for OK

Module:
AA 01 54 00 A9 AA
 # Length of the return = 1 byte;
*Command ID to ACK = 0x***54***;*
Return = 0x00 (OK);
Checksum = 0x **A9**

Stop recording AVI

Host:
aa 01 54 a9 aa
0xaa 01 55 aa
Wait for OK

Module:
AA 01 54 00 A9 AA
 # Length of the return = 1 byte;
*Command ID to ACK = 0x***54***;*
Return = 0x00 (OK);
Checksum = 0x **A9**

100 – 0x64 – Select the storage media

ID	0x64
Description	Select the storage media Parameter: Resident / external
ID Command	0xaa 01 64 b9 aa
Operation Mode	Preview mode
Parameter Command	0xaa Z_1Z_0 Ch_1Ch_0 aa Z_1Z_0: Resident / external 0x00: Resident, 0x01: External Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed / 0x02: USB mode / 0x03: Mode error

Example,
Select the external memory as the storage media

Host:
0xaa 01 64 b9 aa
0xaa 01 55 aa
Wait for OK

Module:
0xaa 01 64 00 b9 aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x64;
Return = 0x00 (OK);
Checksum = 0xb9

101 – 0x65 – Format the storage media

ID	0x65
Description	Format the storage media Parameter: Resident / external
ID Command	0xaa 01 65 ba aa
Operation Mode	Preview mode
Parameter Command	0xaa Z_1Z_0 Ch_1Ch_0 aa Z_1Z_0: Resident / external 0x00: Resident, 0x01: External Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed / 0x02: USB mode / 0x03: Mode error / 0x06: External memory card write-protect

Example
Format the external memory

Host:
0xaa 01 65 ba aa
0xaa 01 55 aa
Wait for OK

Module:
0xaa 01 65 00 ba aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x65;
Return = 0x00 (OK);
Checksum = 0xba

102 – 0x66 – Request the information of the current storage media

ID	0x66
Description	Request the information of the current storage media Parameter: n/a
ID Command	0xaa 00 66 ba aa
Operation Mode	Preview/playback mode
Parameter Command	n/a
Return from the JPEG Module	0x$Y_{19}Y_{18}$ $Y_{17}Y_{16}$ $Y_{15}Y_{14}$ $Y_{13}Y_{12}$ $Y_{11}Y_{10}$ Y_9Y_8 Y_7Y_6 Y_5Y_4 Y_3Y_2 Y_1Y_0 $Y_{19}Y_{18}$ $Y_{17}Y_{16}$ $Y_{15}Y_{14}$ $Y_{13}Y_{12}$: memory available to be used $Y_{11}Y_{10}$ Y_9Y_8: File count Y_7Y_6 Y_5Y_4: number of picture can be snapped (for JPG) Y_3Y_2 Y_1Y_0: Available time (for AVI) / 0x01: Failed / 0x02: USB mode

Example,
Request the information of the current storage media

Host:
0xaa 00 66 ba aa
Wait for Response

Module:
0xaa OA 66 00 66 fd 00 00 11 00 09 00 18 5f aa
 # Length of the return = 10 bytes;
Command ID to ACK = 0x66;
Return = 0x0066fd00 (Available space: 6749440 bytes),
0x0011 (File count: 17),
0x0009 (Picture left: 9),
0x0018 (Time available for AVI: 24 seconds);
Checksum = 0x5f

120 – 0x78 – Request the file information

ID	0x78
Description	Request the targeted file information, File name, File size and Video length (For AVI ONLY) Memory Unit: Byte Time Unit: Second Parameter: File ID
ID Command	0xaa 02 78 ce aa
Operation Mode	All modes
Parameter Command	0xaa Z_3Z_2 Z_1Z_0 Ch_1Ch_0 aa Z_3Z_2 Z_1Z_0: File ID 0x0001 – 0xffff (The upper limit depend on the memory size) Ch_1Ch_0: Checksum
Return from the JPEG Module	0x$Y_{35}Y_{34}$ $Y_{33}Y_{32}$ $Y_{31}Y_{30}$ $Y_{29}Y_{28}$ $Y_{27}Y_{26}$ $Y_{25}Y_{24}$ $Y_{23}Y_{22}$ $Y_{21}Y_{20}$ $Y_{19}Y_{18}$ $Y_{17}Y_{16}$ $Y_{15}Y_{14}$ $Y_{13}Y_{12}$ $Y_{11}Y_{10}$ Y_9Y_8 Y_7Y_6 Y_5Y_4 Y_3Y_2 Y_1Y_0 $Y_{35}Y_{34}$ $Y_{33}Y_{32}$ $Y_{31}Y_{30}$ $Y_{29}Y_{28}$ $Y_{27}Y_{26}$ $Y_{25}Y_{24}$ $Y_{23}Y_{22}$ $Y_{21}Y_{20}$ $Y_{19}Y_{18}$ $Y_{17}Y_{16}$ $Y_{15}Y_{14}$ $Y_{13}Y_{12}$: Filename $Y_{11}Y_{10}$ Y_9Y_8 Y_7Y_6 Y_5Y_4: File size Y_3Y_2 Y_1Y_0: Video length (for AVI ONLY) / 0x01: Failed / 0x02: USB mode / 0x09: File does not exist

Example,
Request the information of the file of that the ID is 2

Host:
0xaa 02 78 ce aa
0xaa 00 02 56 aa
Wait for Response

Module: (For JPG file)
0xaa 12 78 50 49 43 54 30 30 30 32 2e 4a 50 47 00 00 00 08 0f b2 ae aa
 # Length of the return = 18 bytes;
Command ID to ACK = 0x78;
Return = 0x50494354303030322e4a50470000
(File name: PICT0002.JPG),
0x00080fb2 (File size: 528306 bytes);
Checksum = 0x87

Module: (For AVI file)
0xaa 14 78 50 49 43 54 30 30 30 32 2e 41 56 49 00 00 00 22 ef 80 00 06 83 aa
 # Length of the return = 20 bytes;
Command ID to ACK = 0x78;
Return = 0x50494354303030322e4156490000
(File name: PICT0002.AVI),
0x0022ef80 (File size: 2289536 bytes),
0x0006 (Video length: 6 seconds);
Checksum = 0x83

121 – 0x79 – Download file from the JPEG Module (Function in IDLE mode ONLY)

ID	0x79
Description	Download the targeted file from the Module (Function in IDLE mode ONLY) Parameter: File ID
ID Command	0xaa 02 79 cf aa
Operation Mode	Idle mode
Parameter Command	0xaa Z_3Z_2 Z_1Z_0 Ch_1Ch_0 aa Z_3Z_2 Z_1Z_0: File ID 0x0000 – 0xffff (The upper limit depend on the memory size) Ch_1Ch_0: Checksum
Return from the JPEG Module	0x$Y_{35}Y_{34}$ $Y_{33}Y_{32}$ $Y_{31}Y_{30}$ $Y_{29}Y_{28}$ $Y_{27}Y_{26}$ $Y_{25}Y_{24}$ $Y_{23}Y_{22}$ $Y_{21}Y_{20}$ $Y_{19}Y_{18}$ $Y_{17}Y_{16}$ $Y_{15}Y_{14}$ $Y_{13}Y_{12}$ $Y_{11}Y_{10}$ Y_9Y_8 Y_7Y_6 Y_5Y_4 Y_3Y_2 Y_1Y_0 $Y_{35}Y_{34}$ $Y_{33}Y_{32}$ $Y_{31}Y_{30}$ $Y_{29}Y_{28}$: File size $Y_{27}Y_{26}$ $Y_{25}Y_{24}$: Number of packets $Y_{23}Y_{22}$ $Y_{21}Y_{20}$ $Y_{19}Y_{18}$ $Y_{17}Y_{16}$ $Y_{15}Y_{14}$ $Y_{13}Y_{12}$ $Y_{11}Y_{10}$ Y_9Y_8 Y_7Y_6 Y_5Y_4 Y_3Y_2 Y_1Y_0: File name / 0x01: Failed / 0x02: USB mode / 0x03: Mode error / 0x09: File does not exist

Example
Download the file of that the ID is 3 from the JPEG Module

Host:	*Module:*
aa 01 1e 73 aa	**0xaa 12 79 00 1a 7d 6e 00 1d 50 49 43 54 30 30 30 33 2e 41 56 49 02 aa**
aa 03 57 aa	*# Length of the return = 18 bytes;*
0xaa 02 79 cf aa	*Command ID to ACK = 0x79;*
0xaa 00 02 56 aa	*Return = 0x001a7d6e (File size: 1736046 bytes), 0x001d (Number of packets: 29),*
Wait for Response	*0x50494354303030332e415649 (File name: PICT0003.AVI);*
	Checksum = 0x02
Host: (ACK)	*Module:*
0xaa 01 79 00 ce aa	***0xaa 00 01 (File data: 61434 bytes) (checksum: 2 bytes) aa***
Wait for Packet 0001	***(Packet total size: 0xf000 = 61440 bytes)***
Host: (ACK)	
0xaa 01 79 00 ce aa	*Module:*
Wait for Packet 0002	***0xaa 00 02 (File data: 61434 bytes) (checksum: 2 bytes) aa***
	(Packet total size: 0xf000 = 61440 bytes)
Host: (ACK)	***...***
0xaa 01 79 00 ce aa	
Wait for Packet 0003	
	0xaa 00 1d (File data: 15894 bytes) (checksum: 2 bytes) aa
…	***(Packet total size: 0xf000 = 15900 bytes)***
Host: (ACK)	
0xaa 01 79 00 ce aa	
Download Completed	

122 – 0x7a – Delete the targeted file

ID	0x7a
Description	Delete the targeted file Parameter: File ID
ID Command	0xaa 02 7a d0 aa
Operation Mode	All modes
Parameter Command	0xaa Z_3Z_2 Z_1Z_0 Ch_1Ch_0 aa Z_3Z_2 Z_1Z_0: File ID 0x0000 – 0xffff (The upper limit depend on the memory size) Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed / 0x02: USB mode / 0x06: External memory card wirte-protect / 0x09: File does not exist

Example,
Delete the file of that the ID is 3

Host:
0xaa 02 7a d0 aa
0xaa 00 03 57 aa
Wait for OK

Module:
0xaa 01 7a 00 cf aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x7a;
Return = 0x00 (OK);
Checksum = 0xcf

155 –0x9b – Select the TV Standard

ID	0x9b
Description	Select the TV Standard Parameter: NTSC / PAL
ID Command	0xaa 01 9b f0 aa
Operation Mode	All modes
Parameter Command	0xaa Z_1Z_0 Ch_1Ch_0 aa Z_1Z_0: NTSC / PAL 0x00: NTSC, 0x01: PAL (Default) Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK 0x01: Failed

Example,
Select NTSC as the TV standard

Host:
0xaa 01 9b f0 aa
0xaa 00 54 aa
Wait for OK

Module:
0xaa 01 9b 00 f0 aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x9b;
Return = 0x00 (OK);
Checksum = 0xf0

159 – 0x9f – Select the Baud rate

ID	0x9f
Description	Select the Baud rate Parameter: 115200 / 57600
ID Command	0xaa 01 9f f4 aa
Operation Mode	All Modes
Parameter Command	0xaa Z_1Z_0 Ch_1Ch_0 aa Z_1Z_0: Baud rate 0x04: 57600bps, 0x05: 115200bps (Default) Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed

Example,
Select 115200bps for baud rate

Host:
0xaa 01 9f f4 aa
0xaa 05 59 aa
Wait for OK

Module:
0xaa 01 9f 00 f4 aa
 # Length of the return = 1 byte;
Command ID to ACK = 0x9f;
Return = 0x00 (OK);
Checksum = 0x5f

169 – 0xa9 – Request the connection status of the external memory

ID	0xa9
Description	Request the connection status of the external memory Parameter: n/a
ID Command	0xaa 00 a9 fd aa
Operation Mode	All modes
Parameter Command	n/a
Return from the JPEG Module	0x06: External memory card write-protect / 0x07: Connect / 0x08: Disconnect

Example,
Request the connection status of the external memory

Host:
0xaa 00 a9 fd aa
Wait for Response

Module:
0xaa 01 a9 07 05 aa
 # Length of the return = 1 byte;
Command ID to ACK = 0xa9;
Return = 0x07 (connect);
Checksum = 0x05

176 – 0xb0 – Synchronization signal

ID	0xb0
Description	Send this command to the Module for synchronization until receiving "OK" Parameter: n/a
ID Command	0xaa 00 b0 04 aa
Operation Mode	All modes
Parameter Command	n/a
Return from the JPEG Module	0x00: OK

Example,
Send a series of sychronization signal to the Module

Host: **0xaa 00 b0 04 aa** ***Wait for Response (10ms for 115200bps)***	*Module:* ***No response***
Host: **0xaa 00 b0 04 aa** ***Wait for Response (10ms for 115200bps)***	*Module:* ***No response*** **. .**
Host: **0xaa 00 b0 04 aa** ***Wait for Response (10ms for 115200bps)***	*Module:* **0xaa 01 b0 00 05 aa** *# Length of the return = 1 byte;* *Command ID to ACK = 0xb0;* *Return = 0x00 (OK);* *Checksum = 0x05*

200 – 0xc8 – Playback the current AVI

ID	0xc8
Description	Playback the current AVI Parameter: Play / Pause / Stop / Fast Forward / Backward
ID Command	0xaa 01 c8 1d aa
Operation Mode	playback mode
Parameter Command	0xaa Z_1Z_0 Ch_1Ch_0 aa Z_1Z_0: Playback operation 0x00: Play, 0x01: Pause, 0x02: Stop, 0x03: Fast Forward, 0x04: Backward Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed / 0x02: USB mode / 0x03: Mode error

Example,
Play the current AVI

Host: **0xaa 01 c8 1d aa** **0xaa 00 54 aa** ***Wait for OK***	*Module:* **0xaa 01 c8 00 1d aa** *# Length of the return = 1 byte;* *Command ID to ACK = 0xc8;* *Return = 0x00 (OK);* *Checksum = 0x1d*

201 – 0xc9 – Select the Previous / Next file

ID	0xc9
Description	Select the Previous / Next file Parameter: Previous / Next
ID Command	0xaa 01 c9 1e aa
Operation Mode	playback mode
Parameter Command	0xaa Z_1Z_0 Ch_1Ch_0 aa Z_1Z_0: Direction 0x00: Previous, 0x01: Next Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed / 0x02: USB mode / 0x03: Mode error

Example
Select the next file

Host:
0xaa 01 c9 1e aa
0xaa 01 55 aa
Wait for OK

Module:
0xaa 01 c9 00 1e aa
 # Length of the return = 1 byte;
Command ID to ACK = 0xc9;
Return = 0x00 (OK);
Checksum = 0x1e

202 – 0xca – Select a particular file

ID	0xca
Description	Select a particular file Parameter: File ID
ID Command	0xaa 02 ca 20 aa
Operation Mode	Playback mode
Parameter Command	0xaa Z_3Z_2 Z_1Z_0 Ch_1Ch_0 aa Z_3Z_2 Z_1Z_0: File ID 0x0000 – 0xffff (The upper limit depend on the memory size) Ch_1Ch_0: Checksum
Return from the JPEG Module	0x00: OK / 0x01: Failed / 0x02: USB mode

Example,
Select the file of that the ID is 20

Host:
0xaa 02 ca 20 aa
0xaa 00 14 68 aa
Wait for OK

Module:
0xAA 01 CA 00 1F AA
 # Length of the return = 1 byte;
Command ID to ACK = 0xca;
Return = 0x00 (OK));
Checksum = 0x1f

Appendix

1. Example flow of functions

a) Capture a JPEG

	Host	Module
1. synchronization		
	aa 00 b0 04 aa (repeat until module acks)	aa 01 b0 00 05 aa
2. select capture JPG Mode		
	aa 01 1e 73 aa	-
	aa 04 58 aa	aa 01 1e 00 73 aa
3. capture a JPG	aa 01 38 8d aa	-
	aa 01 55 aa	aa 01 38 00 8d aa

b) Capture a video clip

	Host	Module
1. synchronization		
	aa 00 b0 04 aa (repeat until module acks)	aa 01 b0 00 05 aa
2. select video mode		
	aa 01 1e 73 aa	-
	aa 05 59 aa	aa 01 1e 00 73 aa
3. start video	aa 01 54 a9 aa	-
	aa 00 54 aa	aa 01 54 00 a9 aa
	aa 01 54 a9 aa	-
4.stop video	aa 01 55 aa	aa 01 54 00 a9 aa

c) Transits a JPG to host

	Host	Module
1. synchronization		
	aa 00 b0 04 aa	aa 01 b0 00 05 aa
2. select idle mode		
	aa 01 1e 73 aa	-
	aa 03 57 aa	aa 01 1e 00 73 aa
3. select file #1 and transit		
	aa 02 79 cf aa	-
	aa 00 01 55 aa	aa 12 79 00 01 df b3 00 02 50 49 43 54 30 30 32 2e 4a 50 47 75 aa (that mean it has 122803byte, 2packets)
4. send ACK		
	aa 01 79 00 ce aa	aa 00 01 ff db ff e1 0a 6b 45 78….. received first pack of the image data
5. send ACK again		
	aa 01 79 00 ce aa	received another pack of the picture's data
		-
6.completed		
	aa 01 79 00 ce aa	

2. ASCII code table

Dec	Hex	Character	077	04D	M
032	020	SP	078	04E	N
033	021	!	079	04F	O
034	022	"	080	050	P
035	023	#	081	051	Q
036	024	$	082	052	R
037	025	%	083	053	S
038	026	&	084	054	T
039	027	'	085	055	U
040	028	(	086	056	V
041	029	)	087	057	W
042	02A	*	088	058	X
043	02B	+	089	059	Y
044	02C	,	090	05A	Z
045	02D	-	091	05B	[
046	02E	.	092	05C	\
047	02F	/	093	05D	]
048	030	0	094	05E	^
049	031	1	095	05F	_
050	032	2	096	060	`
051	033	3	097	061	a
052	034	4	098	062	b
053	035	5	099	063	c
054	036	6	100	064	d
055	037	7	101	065	e
056	038	8	102	066	f
057	039	9	103	067	g
058	03A	:	104	068	h
059	03B	;	105	069	i
060	03C	<	106	06A	j
061	03D	=	107	06B	k
062	03E	>	108	06C	l
063	03F	?	109	06D	m
064	040	@	110	06E	n
065	041	A	111	06F	o
066	042	B	112	070	p
067	043	C	113	071	q
068	044	D	114	072	r
069	045	E	115	073	s
070	046	F	116	074	t
071	047	G	117	075	u
072	048	H	118	076	v
073	049	I	119	077	w
074	04A	J	120	078	x
075	04B	K	121	079	y
076	04C	L	122	07A	z

Document Change Log

Feb 08, 2007 – official released v1.0
Nov 16, 2007 – modify commands, add operation mode